6 Ultimate Concepts for Transportation Facilities

6.1 Introduction

This chapter presents the recommendations for transportation improvements in the southwest valley to be considered for inclusion in the MAG Regional Transportation Plan (RTP). The purpose of this paper is to provide recommendations for the ultimate concepts for new and existing facilities. The RTP will consider these recommendations and identify specific facilities for funding over the next twenty years. Facility concepts that are not selected for funding or only for partial funding and constructed in the RTP process will remain as ultimate concepts. In addition to recommending facilities for further consideration as the RTP process proceeds, this paper presents estimated costs for each major facility improvement.

Specific alignments and design of facilities recommended for inclusion in the RTP are not established by this paper. If new facilities that are recommended for funding in this paper are selected for inclusion in the RTP, detailed location and design concept studies will be conducted in the future by the Arizona Department of Transportation (ADOT) to provide information in determining precise alignments and design. It is possible that lower functional classification facilities could be built initially in corridors recommended for major new freeways or expressways, with upgrading to higher class facilities considered subsequently.

The costs of the projects recommended for consideration in the next steps of development of the RTP are based on the application of unit costs to the recommended projects. In the case of transit projects, costs are taken from MAG's High Capacity Transit Study (HCTS) and from the the Regional Public Transportation Authority's (Valley Metro's) Regional Transit System Study (RTS). In the case of highway bridges a cost per square foot is used. In the cases of other highway and non-motorized projects a cost per linear mile is used, unless more detailed estimates for the project are available. Costs are in current dollars and are based on recent construction. Each section below provides an explanation of the details of cost estimation in the section. Unit costs are consistent with MAG's Northwest and Southeast area studies.

Crossings of major rivers are included among the recommendations because of the number of rivers in the study area and the higher calculable costs of providing bridges across them. Cost estimates are included for the major river crossings of the Salt River, the Gila River, the Agua Fria River, and the Hassayampa River.

This chapter concludes with a summary of the estimated costs of the facilities recommended for further action in the development of the RTP.

6.2 Highway Facilities

This section presents a summary of the highway facilities recommended for further consideration in the process of developing the metropolitan RTP. It identifies the recommendations for highway improvements and the costs associated with each recommendation. The recommendations have their foundation in the previous chapter, to which the reader is referred for information and analysis supporting each recommendation.

6.2.1 Arterials

Evaluation of the model outputs indicated that 30 percent of the arterial network should have 6 lanes and the remainder 4 lane. That mixture is recommended for the arterial network shown in Figure 6-1. The figure shows some, but not all, of the 6 lane arterial facilities needed, particularly in the areas west of Airport Road and in southern Goodyear.

The arterial system will be implemented by local jurisdictions. Therefore, it is subject to change following further study, particularly in Goodyear where arterial planning is on-going. For example, the locations of the Arterial Roadway Corridors (ARCs) shown in Figure 6-1 could change or the arterial system serving the Estrella Mountain Ranch development could be updated. The phasing of improvements is dependent on both land development and traffic demand.

It is recommended that the basic grid configuration of the network of the existing arterial system be continued in the undeveloped portions of the study area. Some deviations from the grid, for topographic and other reasons, are expected. The minimum basic arterial cross section recommended is a 4 lane standard.

6.2.1.1 Cost Estimate

Arterial costs are shown in Table 6-1. The unit costs are based on recent construction. The costs include $200,000 per mile for bike facilities, either on a widened shoulder or on a separate path paved with asphalt. The costs also include $200,000 per mile for 30 percent of the arterial mileage to provide ITS enhancements for signal coordination and speed and capacity improvements. The estimated arterial mileage and associated cost for the ITS enhancement is beyond the expanded Smart Corridor System developed by MAG.

The costs shown in Table 6-1 are for the network shown in Figure 6-1. The costs assume that 30 percent of the new arterials in the network will be built with 6 lanes and 70 percent with 4 lanes. The costs also assume that 70 percent of arterial widenings include 2 lanes and 30 percent include 4 lanes. This would provide the desired 30 percent of arterials with 6 lanes if all arterials being widened were 2 lane facilities before widening. Thus the estimate overstates the total costs of arterial widening to the extent that 4 lane arterials are widened to 6 lanes. The costs assume that land for all new arterials will be acquired by dedication at no public cost. The costs assume that widenings from 2 to 4 lanes will require no additional right-of-way, but that widenings from 4 to 6 lanes will require additional right-of-way costing $1 million per mile.

The distribution of arterial improvement costs among private land developers, municipalities, and Maricopa County is not discernible and has therefore not been estimated. Two major factors that

Figure 6-1
Ultimate Concept for Lanes on the Arterial Network

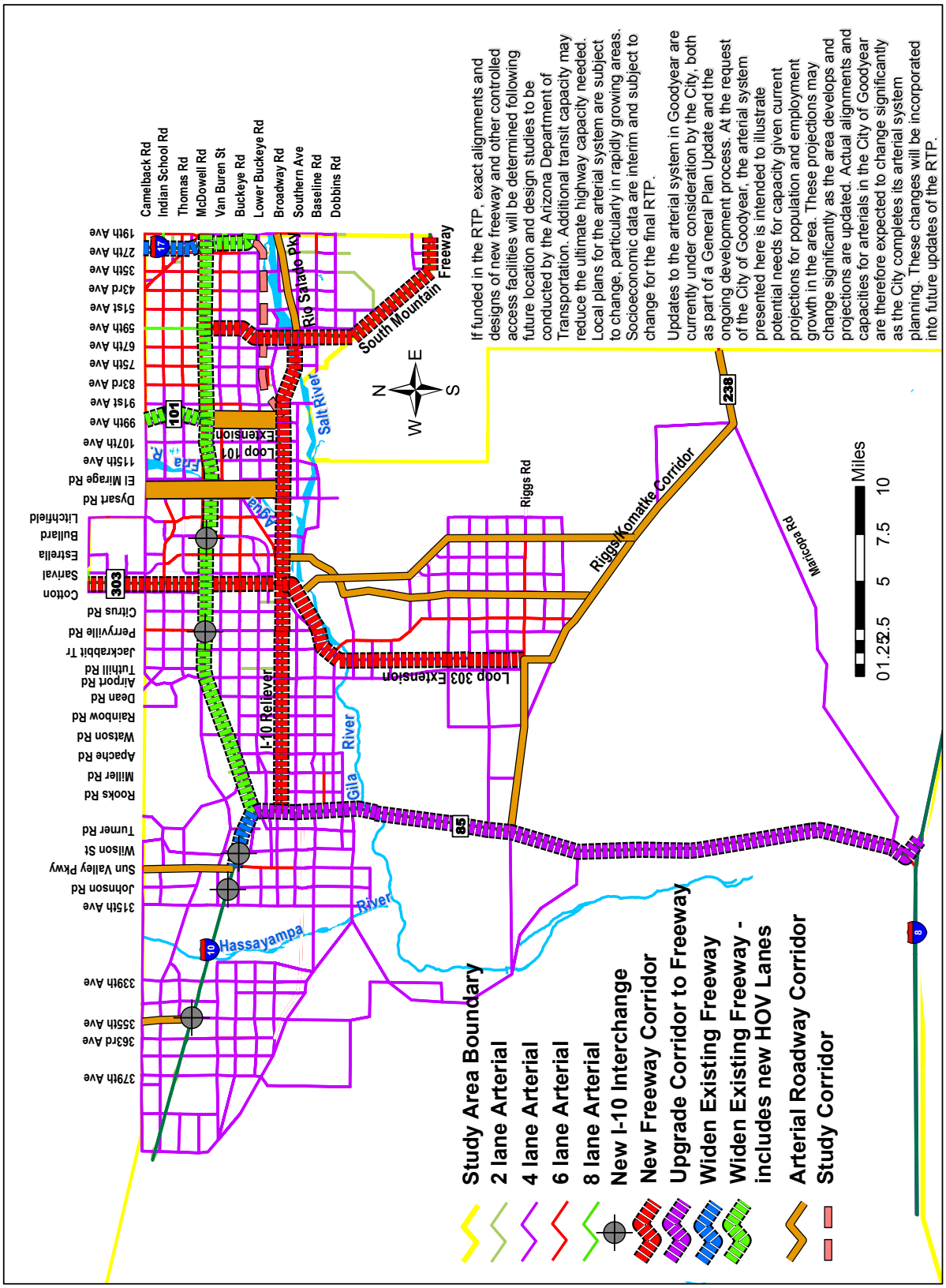


Table 6-1
Arterial Network Costs
(in millions of constant 2003 dollars)

	Cost per Mile	Centerline Miles	Estimated Cost
New 4 Lane	$3.0	206.3	619
New 6 Lane	4.0	88.4	354
Widen by 2 Lanes	3.5	437.6	1,532
Widen by 4 Lanes	4.5	187.5	844
Bike Facilities	0.2	1,057.1	211
ITS	0.2	317.1	63
Total			**$3,623**

Note: These estimates are preliminary and may be superseded by estimates in the RTP.

will affect the distribution of these costs between the private and public sectors are the type of land development, the size of individual developments, and the extent to which development is contiguous. Whether land is developed for residential, commercial, industrial, or recreational purposes strongly influences the amount of traffic the land use will create on adjacent streets and highways. Development with more intense traffic generation will result in more private sector contribution to the development of arterial system upon which much of the traffic generated can be expected to travel. Development of uses with less intensive traffic generation results in less impact to the arterial system and thus less demand upon developers to provide arterial improvements.

Similarly, small developments will have smaller levels of traffic generation. Development of smaller uses with smaller amounts of traffic generation results in less impact to the arterial system and thus less demand upon developers to provide arterial improvements. However, the cumulative impacts of smaller developments can be greater than larger developments, thus increasing the need for the public sector to fund arterial improvements.

Development which is not contiguous can create arterials of varying width (known as "scalloped streets" because of the changing curb location). As the development of land whose access depends upon the narrow sections of an arterial roadway increases, the ability of the narrow sections to handle traffic demand may deteriorate to the point that the public sector is pressured to remove the traffic bottlenecks created by the narrow sections.

In order to address the "scalloped streets" issue, it is recommended that local jurisdictions create a local or cross-jurisdictional policy for contiguous, standard roadway cross-sections along with an identified funding source such as impact fees.

6.2.2 Major Arterial River Crossings

Three new arterial major river bridge crossings are needed:

- Rainbow Valley Road over the Gila River;
- Thomas Road over the Agua Fria River; and
- Camelback Road or Tonopah-Salome Highway over the Hassayampa River.

The Tonopah-Salome Highway bridge over the Hassayampa River is recommended for the third location since it will require a shorter span, and thus lower cost, than a bridge on Camelback Road.

The Camelback Road location could be improved with a low lying river crossing that would flood during storm events. These two Hassayampa River crossings could be funded by nearby land developers.

Construction of these three new arterial bridges is shown in Figure 6-2 along with actions recommended at each river crossing location. An arterial bridge at 59th Avenue to serve local traffic may also be needed ultimately, especially if the final location determined in the ongoing Design Concept Study for the South Mountain Freeway is not in the 59th Avenue corridor. These 4 bridges are recommended and are included in the cost estimate for projects to include in the continuing development of the RTP.

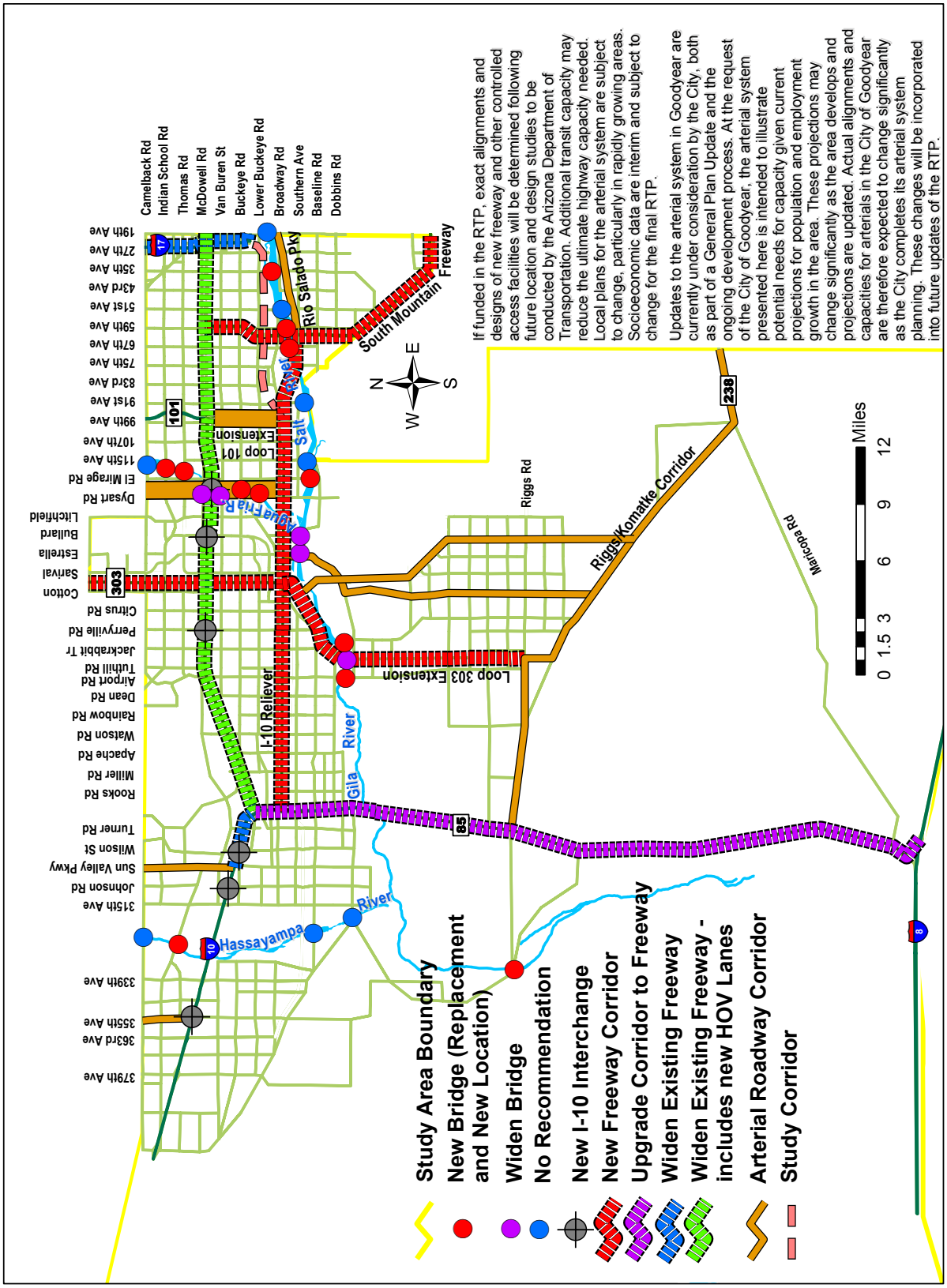
A number of existing major arterial river crossings will require widening. In some cases the existing bridge can be expected to be demolished and a new bridge constructed. In other cases, the existing bridge may be widened. In a number of cases existing river crossings do not involve a bridge, but low-lying roads that may flood during storm events. All of the existing arterial river crossings are

Table 6-2
Arterial Crossings of Major Rivers: Improvements and Cost Estimates
(in millions of constant 2003 dollars)

Road	River	Current Lanes	Future Lanes	Add'l Lanes	Current Condition	Action	Est'd Cost
19th Ave	Salt	4	4	0	Not Deficient	None	
35th Ave	Salt	2	4	2	Deficient	Build	$4.7
51st Ave	Salt	2	4	2	Not Deficient	None	
59th Ave	Salt	0	4	4	No Crossing	Build	9.4
67th Ave	Salt	2	4	2	Road	Build	9.4
91st Ave	Salt	2	4	2	Road	None	
115th Ave	Gila	4	4	0	Not Deficient	None	
El Mirage	Gila	4	4	0	Road	Build	46.8
Bullard	Gila	2	4	2	Not Deficient	Widen	7.3
Estrella Parkway	Gila	2	4	2	Not Deficient	Widen	11.5
Rainbow Valley	Gila	0	4		No Crossing	Build	24.0
Tuthill	Gila	2	4	2	Not Deficient	Widen	8.3
Airport	Gila	2	4	2	Road	Build	18.7
Old US 80	Gila	2	4	2	Deficient	Build	15.6
Camelback	Agua Fria	4	4	0	Not Deficient	None	
Indian School	Agua Fria	4	4	0	Deficient	Build	15.2
Thomas	Agua Fria	0	6		No Crossing	Build	13.6
McDowell	Agua Fria	4	6	2	Not Deficient	Widen	5.8
Van Buren	Agua Fria	4	6	2	Not Deficient	Widen	3.1
CR-85	Agua Fria	4	4	0	Not Deficient	Build	11.3
Lower Buckeye	Agua Fria	2	4	2	Road	Build	23.4
Tonopah Salome	Hassayampa	2	4	2	Road	Build	11.0
Baseline	Hassayampa	2	4	2	Road	None	
Old US 80	Hassayampa	2	4	2	Not Deficient	None	
Total							**$239.0**

Note: This table mainly reflects improvements to existing bridges. Additional highways may need bridges. Therefore these estimates are low. These estimates are preliminary and may be superseded by estimates in the RTP.

Figure 6-2
Recommended Bridge Actions at Major River Arterial Crossings



shown in Table 6-2 along with the 4 new crossings noted above. The costs of widening, replacing, or constructing bridge facilities at these locations are included in the cost estimate for projects recommended for inclusion in the RTP.

Table 6-2 shows the current number of lanes at each major arterial river crossing along with the number of lanes needed in the future. The current condition of bridges at these crossings is also shown, derived from available NBIS data which typically provides: year built, sufficiency rating, deck width, bridge length, and other details. Actual condition evaluations are not included in this planning study, nor are normal maintenance or emergency repair costs. It is further assumed that all existing and proposed bridges will require normal maintenance over time and may require repairs or replacement for conditions not considered in this study. The categories of current bridge condition are:

- Not deficient – a bridge with no major deficiencies, but which may be scour critical or not meet current rail safety standards;
- Deficient – a bridge with a sufficiency rating indicating that the bridge is functionally obsolete;
- No crossing – a location with no river crossing currently; and
- Road – a location with a low-lying road that may flood during storm events.

The table shows the action needed at each major arterial river crossing:

- Widen – the existing bridge is not functionally obsolete but is too narrow to accommodate future traffic demand;
- Build – construction of a bridge at this location is needed either because there is no existing bridge or the existing bridge is functionally obsolete; and
- None – the existing bridge has not functionally obsolete and is wide enough to handle the number of future lanes, or the existing crossing is a low-lying road for which a bridge replacement is not indicated.

No bridge construction is indicated at two low-lying crossings. These are 91st Avenue across the Salt River and Baseline across the Hassayampa River. In each case, the forecast traffic volumes are too low to justify widening of the existing facility or bridge construction before 2030. As noted above, the use of 2030 as the planning horizon may be too short a time frame upon which to base the need for a bridge at these locations.

6.2.2.1 Cost Estimate

Table 6-2 shows the estimated costs for arterial bridges crossing major rivers in the study area. The table shows the number of lanes to be added for bridge widening and the number of lanes for new construction. Completed width will be 78 feet for 4 lane bridges and 100 feet for 6 lane bridges. Bridge length was estimated based on the length of existing facilities, nearby facilities, and aerial photography. A unit cost of $120 per square foot was used to estimate costs at each crossing. The cost estimate for widening of the Estrella Parkway bridge over the Gila River is based on construction of a second parallel 44 foot wide bridge, rather than a widening of the existing bridge. There are no separate cost estimates included for the demolition of existing bridges where new replacement bridges would be constructed.

6.2.3 Freeways, Expressways, Parkways and ARCs

The following sections present the individual freeway, expressway, parkway and arterial roadway corridor (ARC) facilities recommended for inclusion in the RTP. The recommended corridors are shown in Figure 6-3. Facilities needed to meet 2030 forecast traffic demand are shown in Figure 6-3 and their estimated costs are presented in Table 6-3. It is important to note that although this study could not quantify the effects of additional transit capacity, ultimate roadway capacity needed may be reduced with additional transit capacity.

Facilities categorized as freeways generally are high volume, high speed, and limited access via specific access points such as interchange ramps, with non-motorized restrictions. New expressways have partial access control and to be upgradeable to freeway standards at a later time.

Parkways are similar to expressways relative to operations, with enhanced aesthetics such as landscaping and beautification. Parkways may or may not be upgradeable to full freeway standards. Arterial roadway corridors (ARCs) are enhanced arterials, and are defined in this study as a minimum 4 lane facilities, primarily in the urban area. ARCs may or may not be upgradeable to expressways, parkways, or freeways at a later time. Upgrading facilities from one category to another will depend on such criteria as capacity demand, available funding, and local and regional support. Alignments and designs of any new freeway, expressway, parkway or ARC will be determined in location and design studies to be conducted by ADOT in the future.

6.2.3.1 Cost Estimation

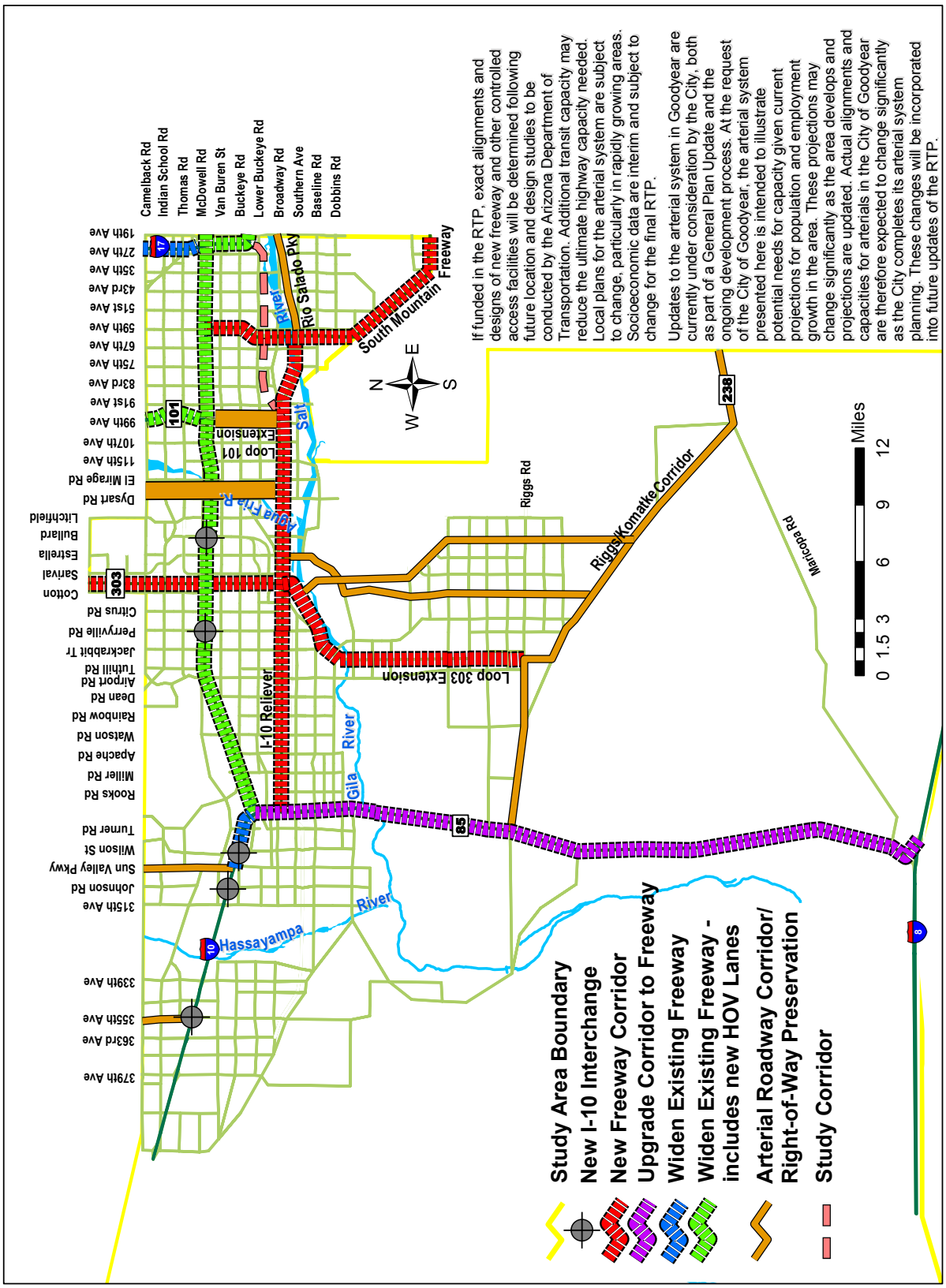
The estimated costs of the freeway and expressway facilities recommended for further consideration in development of the RTP are presented in Table 6-3. Freeway and expressway costs per mile for widening and new construction are shown in Table 6-4. The table shows the estimated cost of new freeway and expressway facilities of various widths and under three right-of-way acquisition scenarios in which no right-of-way acquisition is required, half of the right-of-way must be acquired by purchase, and all of the right-of-way must be acquired by purchase. Right-of-way acquisition estimates must be treated with extreme caution because these costs vary widely.

Costs for new construction of freeways are extrapolated from recent construction costs for a 6 lane freeway and include typical interchanges, overpasses and underpasses, and other standard freeway facilities. Because of their high cost, freeway to freeway interchanges (system interchanges) are a separate cost item at $100 million each for a full interchange between two freeways neither of which ends at the interchange. System interchange costs for an interchange at which one freeway terminates are estimated at $50 million. System interchange costs for separate HOV lane improvements are estimated at $35 million, with the only such occurrence in the SWATS area at the interchange of I-10 and Loop 101 calculated at $17 million due to the northerly termination of the Loop 101 Extension at I-10.

Costs for freeway widenings are extrapolated from recent construction costs for adding two lanes (one in each direction). The addition of multiple lanes in a direction is estimated to enjoy an economy of scale reflected in Table 6-4. Existing right-of-way is assumed to be sufficient to accommodate widenings up to 4 lanes. Right-of-way acquisition is assumed to be required for widenings of more than 4 lanes. Based on recent construction, costs for additional interchanges along existing freeways are estimated at $16 million per interchange including right-of-way.

Freeway widening and new freeway construction include $1 million per mile to provide instrumentation for traffic management, as shown in the ITS column of Table 6-3.

Figure 6-3
Ultimate Concepts for Major Highway Infrastructure Based on 2030 Demand Estimates



Wilbur Smith Associates

Table 6-3
Estimated Costs* of Ultimate Concepts

(all costs in millions of constant 2003 dollars)

Facility	Miles in SWATS Area	New	Widen	Additional Interchanges & Intersection Improvements	Freeway System Interchanges	Major Bridges	ITS	Bikeway	Total
Arterial Roadways									
Arterials	295	$972	$2,376				$63	$211	$3,623
Major River Arterial Bridges						239			239
Subtotal Arterial Roadways		**$972**	**$2,376**	**$0**	**$0**	**$239**	**$63**	**$211**	**$3,862**
Freeways									
I-10: I-17 to Loop 101	9		734		23		**		757
I-10: Loop 101 to Loop 303	9		254	32		***	**		286
I-10: Loop 303 to SR-85	12		346	16			**		362
I-10: SR-85 to Sun Valley Parkway	3		77	16			**		93
I-10: SR-85 to County Line	39			35					35
I-17: I-10 (west) to Camelback†****	3		230						230
I-17: I-10 (west) to 19th Avenue	3		33						33
South Mountain Freeway†	15	755			50	33	15		853
SR-85 north of Gila River	7	50			50	26	7		133
SR-85 south of Gila River	30	40			50		30		120
I-10 Reliever: I-17 to Loop 101 Extension	10	666			200		10		875
I-10 Reliever: Loop 101 to Loop 303	9	644			50	73	9		776
I-10 Reliever: Loop 303 Extension to SR-85	12	553			100		12		665
Loop 101 Widening: I-10 to Camelback†	3	46			35				81
Loop 303 Extension: Northern to I-10†	6	285			45		6		336
Loop 303 Extension: I-10 to I-10 Reliever	5	235			50		5		290
Loop 303 Extension: I-10 Reliever to Riggs Rd	13	602			50	47	13		712
Subtotal Freeways		**$3,875**	**$1,674**	**$99**	**$703**	**$179**	**$107**	**$0**	**$6,638**
Expressways/Parkways									
Loop 101 Extension††	3	21		16			1	1	39
Sun Valley Parkway: I-10 to Camelback†	5		17	13			1	2	32
Rio Salado Parkway†	10	37					**	4	41
Subtotal Expressways/Parkways		**$58**	**$17**	**$29**	**$0**	**$0**	**$2**	**$7**	**$112**
Transit (based on HCTS and RTS)									
LRT: I-10 from downtown Phoenix to Loop 101		400							400
LRT: 51st/59th Ave corridor north of Baseline Rd		730							730
Commuter rail: downtown Phoenix to Buckeye		450							450
Park-and-ride, I-10 @ Litchfield Road		3							3
Park-and-ride, I-10 @ Miller Road		3							3
Park-and-ride, I-10 @ 339th Avenue		3							3
Bus Rolling Stock		700							700
Subtotal Transit		**$2,289**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$2,289**
Multi-Purpose Paved Trails									
Grand Canal: 19th Ave to 75th Ave†	8							3	3
Agua Fria River Bank†	10							3	3
Gila-Salt River: Agua Fria to Rio Salado Expwy	9							3	3
Gila River Bank: Agua Fria to SR-85	17							6	6
Gila River Bank west of SR-85	6							2	2
Roosevelt Canal: Agua Fria to SR-85	20							7	7
Roosevelt Canal: SR-85 to Hassayampa	8							3	3
Waterman Wash	13							5	5
Hassayampa River†	14							5	5
Subtotal Multi-Purpose Paved Trails		**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$37**	**$37**
GRAND TOTAL		**$7,194**	**$4,067**	**$128**	**$703**	**$418**	**$172**	**$256**	**$12,937**
Percent of Total		56	31	1	5	3	1	2	100

**These estimates are preliminary and may be superseded in the RTP.*

***Included in "New" or "Widen" cost.*

****Major expansion or replacement of the I-10 bridge over the Agua Fria River will be required to accommodate I-10 widening.*

*****Specific improvements to be determined.*

†Project crosses the SWATS area boundary. Estimated cost includes only the portion within the SWATS area.

††Cost estimate is for a 6-lane parkway facility.

LRT projects would cost approximately half as much if developed as BRT projects on exclusive right-of-way.

LRT, Bus Rolling Stock, and Commuter Rail include costs for portions of projects outside the SWATS area.

Bikeway and ITS costs on major bridges are included in the bridge costs.

Some bridge costs for new roadways are included in new roadway costs and some are shown separately in the bridge column.

Table 6-4
Estimated Freeway and Expressway Improvement Costs per Mile including Right-of-Way Acquisition
(in millions of constant 2003 dollars)

		Right-of-Way		
Improvement Type	**Lanes**	**No Cost**	**Full Purchase**	**Half Purchase**
Expressway				
New	4	$3.5	$5.5	*$5.0*
	6	*4.5*	6.5	6.0
Widen	2	3.5		
Freeway				
New	4	*20.0*	*35.0*	27.0
	6	*25.0*	*40.0*	32.0
	8	*35.0*	45.0	40.0
	10	*40.0*	50.0	45.0
	12	*45.0*	60.0	52.0
	14	*50.0*	65.0	*57.0*
	16	*55.0*	70.0	*62.0*
Widen	*2,0	8.0		
	2,2	14.0		
	4,0	*14.0*		
	2,4		25.0	
	4,2		25.0	
	4,4		*31.0*	
	6,0		*25.0*	
	6,2		31.0	
Parallel Separate Bikeway		0.36		

Notes:
**General purpose lanes, HOV lanes*
Italic values are not actually used in any estimate but make the table comprehensive.
These estimates are preliminary and may be superseded by setms in the RTP.

Major freeway and expressway river crossings are estimated as additional costs. Bridge length is estimated based on the length of upstream and/or downstream bridges. Freeway bridges are assumed to be separately constructed for each direction. Freeway bridge width is 12 feet per lane plus 24 feet for shoulders on both sides. An additional 2 feet of width is provided on freeway bridges carrying 4 or more lanes to accommodate separation between HOV and general purpose lanes.

Expressway bridge width is 12 feet per lane plus 40 feet for two 12 foot shoulders and 16 feet of sidewalk and railings. Separate multi-purpose paths parallel to expressways are assumed to cross major rivers on shoulders or sidewalks or on low-lying roadbeds with culverts which would be expected to flood during storm events.

Costs for new construction of expressways are based on recent construction cost estimates for arterial roadways. Right-of-way costs are additional as shown in Table 6-4. Intersection improvements are included for expressways at $2.5 million per intersection plus $0.75 million per

intersection where right-of-way purchase is required. These cost estimates are based on recent arterial intersection construction and right-of-way costs. Costs for new expressways and arterials upgraded to expressways, include costs for providing a separate, parallel, and paved bikeway or multi-purpose path at $360,000 per mile. The costs also include $200,000 per mile for 30 percent of the arterial mileage to provide ITS enhancements for signal coordination and speed and capacity improvement.

6.2.4 I-10

For the ultimate concepts, widenings are necessary along much of I-10 in the study area. Traffic forecast for 2030 indicates demand for 14 lanes (10 general purpose lanes and 4 HOV lanes) east of Loop 101 to I-17 and 12 lanes (10 general purpose lanes and 2 HOV lanes) west of Loop 101 to SR-85. West of SR-85 to Sun Valley Pkwy demand is forecast for 10 general purpose lanes. West of Sun Valley Parkway no need for widening is forecast. These lane configurations are used as the basis for the cost estimate for I-10 improvements is shown on Table 6-5.

Table 6-5
Widenings Recommended on I-10

		Lanes			
		Existing		Recommended	
Section Endpoints	Length in Miles	Genl Purpose	HOV	Genl Purpose	HOV
I-17 to 59th Avenue	4.5	4	1	5	2
59th Avenue to 83rd Avenue	3.0	3	1	5	2
83rd Avenue to Loop 101	1.8	4	0	5	2
Loop 101 to Dysart	4.2	3	0	5	1
Dysart to Loop 303	4.6	2	0	5	1
Loop 303 to Jackrabbit Trail	3.4	2	0	5	1
Jackrabbit Trail to Watson Road	4.7	2	0	5	1
Watson Road to SR-85	4.2	2	0	5	1
SR-85 to Sun Valley Parkway	3.1	2	0	5	0
Sun Valley Parkway to County Line	39.0	2	0	2	0

Despite these widenings, congestion on I-10 is forecast east of Loop 303. Additional east/west capacity on the I-10 Reliever and the Rio Salado Parkway, as noted below in their respective sections, will be needed to provide adequate high speed east/west capacity.

Six new interchanges are included in the cost estimate for I-10. A new interchange is currently under construction at Watson Road and no cost is included here. A new interchange is planned at Sarival Avenue as part of the Loop 303 Extension, where its costs are included. The Loop 303 Extension will also require replacement of the Cotton Road interchange with I-10 and those costs are included in the Loop 303 Extension. The interchange at El Mirage Road is recommended for further study, due to the length of bridge required to cross the Agua Fria River north of the interchange and the presence of a subdivision along its potential alignment north of the interchange. The 6 new interchanges along I-10 included in the cost estimate are located at:

- El Mirage Road (depending on local development plans);
- Bullard Road;
- Perryville Road;
- Wilson Avenue;
- Johnson Road; and
- 355rd Avenue (the future CANAMEX Highway).

Completion of a full HOV interchange at 79th Avenue and implementation of an HOV interchange at 55th Avenue are also recommended.

6.2.4.1 Cost Estimate

Table 6-3 includes the estimated costs of implementing the improvements shown in Table 6-5. The estimate includes costs for the 6 new general purpose interchanges noted above, as well as the HOV interchanges identified. An estimate for construction of the HOV ramps between the I-10 and Loop 101 HOV lanes in also included. In addition, bridge improvements over the Agua Fria will be required to carry the widened highway. A cost of about $35 million for two new bridges, each carrying 5 general purpose lanes and 1 HOV lane, has been estimated, but has not been included in Table 6-3 because the need to replace the existing bridges and the required cross sections of the bridges has yet to be determined.

Major new freeway interchanges with the South Mountain Freeway, Loop 101 Extension, Loop 303 Extension, and SR-85 are not included in the I-10 costs, but in the estimate for each of those intersecting facilities. An estimate of improvements for HOV lane connections at the Loop 101 interchange is included in the estimate.

The cost estimate shows the improvements in five sections from east to west.

6.2.5 I-10 Reliever

The I-10 Reliever is a future freeway corridor between the Salt/Gila river corridor and I-10 serving east/west traffic. Travel forecast for 2030 do not indicated the need for this facility west of SR 85. The eastern terminus, currently shown as a connection to I-17, will require a feasibility study to be performed by ADOT. In addition, a connection to I-10 at the Superstition Freeway (US-60) remains an option for further study. A Major Investment Study (MIS) is recommended to study the corridor for I-10, the I-10 Reliever and High Capacity Transit (HCT).

Travel forecast for 2030 shows demand for a 14 lane facility east of the South Mountain Freeway, a 16 lane facility west of the South Mountain Freeway to the Loop 303 Extension, 10 lanes between the Loop 303 extension and Perryville Road, and an 8 lane facility west to SR-85. It is recommended that the I-10 Reliever have a western terminus at SR-85. These characteristics form the basis for the cost estimate for the I-10 Reliever.

6.2.5.1 Cost Estimate

The cost estimate for the I-10 Reliever is shown on Table 6-3. The costs are presented in three sections: from I-17 to the Loop 101 Extension, from the Loop 101 Extension to the Loop 303 Extension, and from the Loop 303 Extension to SR-85. The costs represent the ultimate width in each section as indicated above. The cost estimate for the section between the Loop 101 Extension and the Loop 303 Extension includes a major river crossing of the Agua Fria River.

The cost estimate includes a major freeway system interchange with I-17. Because the I-10 Reliever will end at I-17, the interchange cost is estimated at half the cost of a major interchange. A full cost major interchange is included at the South Mountain Freeway. A full cost major interchange is also included at the Loop 101 Extension, but its costs are split evenly between the I-10 Reliever's two most easterly sections, since the Loop 101 Extension may represent a temporary western terminus of the freeway.

The costs for the major interchange with the Loop 303 Extension are split between the Loop 303 Extension section south of the I-10 Reliever and the I-10 Reliever section west of the Loop 303 Extension. The costs for half a major freeway system interchange with SR-85 are included in the westerly section of the I-10 Reliever on Table 6-3.

6.2.6 I-17

HOV or "carpool" lanes are needed along I-17 south of I-10 west. The cost estimate for the portion of the carpool lanes west of 19th Avenue (in the SWATS area) is shown on Table 6-3.. North of I-10 west I-17 requires additional capacity, but the configuration of that capacity requires further study. Table 6-3 shows funds set-aside for improvements along the section of I-17 north of I-10 to Camelback Road (the SWATS area boundary). Additional study will be required before decisions can be made with respect to improvements in this corridor.

6.2.7 Loop 101 (Agua Fria)

Loop 101 north of I-10 is recommended for widening. Forecast demand is projected for an additional general purpose lane as well as an HOV or "carpool" lane in each direction. The cost of these improvements for the portion of Loop 101 in the SWATS area is shown in Table 6-3.

6.2.8 Loop 101 Extension (Agua Fria)

While a 10-lane freeway facility from I-10 south to the I-10 Reliever appears to be warranted based on demand, this roadway will require more study before the type of facility and number of lanes can be decided, given concern over potential local impacts. At this time, a parkway facility or higher level arterial facility acceptable to local jurisdictions is recommended for consideration in the RTP.

6.2.8.1 Cost Estimate

The cost for this facility is shown in Table 6-3. The estimate is based on a 6 lane parkway facility. An arterial would have slightly lower costs and a freeway substantially higher costs. The estimate includes provision for a bike facility and ITS improvements such as advanced traffic signal coordination.

6.2.9 Loop 202 (South Mountain Freeway)

The South Mountain Freeway connects the Santan Freeway to I-10 by looping around central Phoenix to the south and west as shown on Figure 6-3. Travel forecast for the year 2030 indicates demand for 10 lanes on the South Mountain Freeway. This configuration is recommended for inclusion in the RTP, pending completion of ongoing studies. The recommendations presented here are planning level representations. Actual alignment and design elements will be determined by project specific studies managed by ADOT.

6.2.9.1 Cost Estimate

The estimated costs for the South Mountain Freeway included in Table 6-3 include only the 15.1 mile portion of the facility in the SWATS area. The estimate is for the facility assuming implementation in a single project. The cost estimate includes bridges over the Salt River. The cost estimate also includes a major freeway system interchange with I-10. The I-10 interchange cost is estimated at half the cost of a major interchange.

6.2.10 Loop 303 Extension (Estrella)

The Loop 303 Extension includes the implementation of a freeway on the alignment of the existing Loop 303 and extending that facility south across I-10 and the Gila River into the southern portion of Goodyear. The Loop 303 Extension is needed into southern Goodyear to provide capacity for high speed north-south travel in the area. Travel forecast for the year 2030 indicates demand for 10 lanes from Northern Avenue south into southern Goodyear, and a diminishing number of lanes in southern Goodyear as the facility approaches its southern terminus at Riggs Road.

The recommendation is for inclusion of the Loop 303 Extension in the RTP. This study does not determine the actual alignment of Loop 303. The recommendation is for an additional study, such as a Design Concept Report (DCR), to be conducted by ADOT for alignment and design elements. The Loop 303 Extension, should it be funded, would be expected to be designated a state highway. This DCR would require close consultations with the local communities to fully identify the local issues and needs. The DCR should include consideration of an alignment in the westerly area of southern Goodyear with Arterial Roadway Corridors serving the eastern area.

A cost estimate was developed based on the following 6 sections:

- 10 lanes from Northern Avenue to approximately 10 miles south of the I-10 Reliever;
- 8 lanes for the next 2 miles; and
- 6 lanes for the last mile to Riggs Road.

6.2.10.1 Cost Estimate

The cost estimate for the Loop 303 Extension is shown on Table 6-3. The costs are presented in three sections: north of I-10, I-10 to the I-10 Reliever, and south of the I-10 Reliever. The costs represent the ultimate width in each section as indicated above. The cost estimate for the section south of the I-10 Reliever includes a major river crossing of the Gila River.

The cost estimate also includes major freeway interchanges at I-10 and the I-10 Reliever. The cost of the I-10 interchange is divided between the sections north and south of I-10. Only half the cost of the I-10 Reliever interchange is included in the section south of the I-10 Reliever; the other half is included in the I-10 Reliever section west of the Loop 303.

The cost estimate for the section north of I-10 assumes that additional right-of-way acquisition is necessary north of Thomas Road and that little or none of the existing facility will be of continuing use. In the most southerly section south of the Gila River in southern Goodyear, the cost estimate assumes that half of the right-of-way will be acquired through dedication during the land development process.

6.2.11 SR-85

SR 85 is recommended ultimately to be a freeway from I-10 to I-8 to address demand and potential safety concerns. However, because of the high costs of freeway construction, an interim facility is recommended, consisting of a freeway north of the Gila River and an expressway south of the river. Travel forecasts for 2030 indicate demand for a 6 lane freeway (3 lanes in each direction) from I-10 south across the Gila River. South of the Gila River crossing, demand for a 6 lane expressway is forecast as far as Komatke Road. Demand is forecast for a 4 lane expressway south of Komatke Road to Gila Bend.

The interim facility recommendation is based on information not including complete consideration of the needs of the CANAMEX highway, a major future truck route between Mexico and Canada. That new route is currently planned to enter the study area in the southeast along I-8, travel north along SR-85, continue west along I-10, and leave the study area to the north along 355th Avenue, continuing on Wickenburg Road and Vulture Mine Road. A high speed freeway is ultimately needed to provide an alternative path for through trucks that would otherwise use I-10 through the central Phoenix area. Therefore, a 6 lane freeway is recommended north of Gila River to I-10 and a four lane freeway is recommended south of the Gila River to I-8. This facility, categorized as a freeway, would specifically function as a 'Rural Controlled Access' highway or freeway, and would be built to interstate standards, with frontage roads and interchanges. Frontage roads would provide the local access that would still be needed, as appropriate. Prior to completion of the CANAMEX Highway, the recommended interim facility could be implemented with the expectation of eventual upgrading to a freeway. Again, ADOT would need to be perform studies in the future to determine alignments and design elements.

6.2.11.1 Cost Estimate

The estimated costs for the interim improvements to SR-85 are shown on Table 6-3. Costs for the northernmost 6.5 miles of the freeway, including a bridge over the Gila River, are separated from the remaining portion south to I-8. The cost estimate includes major freeway system interchanges with I-10 and I-8. Because the freeway improvements to SR-85 are planned to end at I-10 and I-8, the interchange cost at each location is estimated at half the cost of a major interchange. A single bridge over the Gila River is included in the cost estimate to carry traffic lanes in one direction. Lanes in the other direction are assumed to use the existing bridge. A cost for the ultimate freeway facility in this corridor, including the Gila River bridge and system interchanges at I-10 and I-8, is estimated at approximately $1.2 billion. This estimate is not shown on Table 6.3.

6.2.12 Sun Valley Parkway

Travel forecasts for 2030 indicate the need to widen and upgrade the Sun Valley Parkway from 4 lanes to 6 lanes. Sun Valley Parkway is recommended to be an ARC, which may or may not be upgraded to a freeway in the future. Sun Valley Parkway, for operations, would need to be upgraded from an arterial to an expressway south of Camelback Road.

6.2.12.1 Cost Estimate

The cost estimate shown in Table 6-3 is based on a widening from 4 to 6 lanes for the 4.9 miles of parkway between I-10 and Camelback Road. The estimate includes upgrades for 5 intersections along the section to be improved. The estimate assumes that any land acquisition will be through dedication during the land development process. The cost estimate includes provision for ITS

improvements to coordinate traffic signals and improve speed and capacity.

6.2.13 CANAMEX Corridor

The CANAMEX Corridor is one of 43 national "high priority" corridors identified in the Intermodal Surface Transportation Efficiency Act (ISTEA); the 1995 National Highway System (NHS) Designation Act; and the Transportation Efficiency Act for the 21st Century (TEA-21). It was conceived as a major commercial and trade route between Mexico and Canada.

In April of 2001, following completion of a study, the MAG Regional Council passed a resolution specifying the corridor within Maricopa County to include: I-8, SR 85, I-10 from SR 85 to the Wickenburg Road/Vulture Mine Road connection, an alignment in the general vicinity of Wickenburg Road/Vulture Mine Road connecting to the future Wickenburg Bypass, and the Wickenburg Bypass from that point west to US 93. Wickenburg Road is generally aligned with 355th Avenue at I-10.

Early preservation of right-of-way is recommended for the portion of the route north of I-10 and within the SWATS area. The route would connect to I-10 at or near 355th Avenue. It is recommended that right-of-way preservation be undertaken as part of the land development process. Costs and improvements to SR 85 and I-10 are included in this study. Costs for improvements for the CANAMEX Corridor north of the SWATS area are included in the NWATS.

6.2.14 Rio Salado Parkway

The Rio Salado Parkway enters the study area from downtown Phoenix and parallels the Salt River to the river's south as far west as 75th Avenue where it crosses the river and turns north ending at the interchange of the Loop 101 Extension and the I-10 Reliever, as shown in Figure 6-3. This new facility includes bridging a major river. There is a need for the Rio Salado Parkway. Travel forecasts indicate demand for a 6 lane facility. Its early implementation may postpone the need for the I-10 Reliever, while early implementation of the I-10 Reliever may postpone or obviate the need for the Rio Salado Parkway. The timing, planning, and implementation of these nearby parallel facilities will require careful coordination.

6.2.14.1 Cost Estimate

The cost estimate for the Rio Salado Parkway is shown in Table 6-3. The estimate includes a major river crossing of the Salt River. Because of the parkway's general east/west orientation a longer bridge is assumed. The interchange costs associated with the major freeway system interchange at the western terminus of the Rio Salado Parkway are included in the cost estimates for the I-10 Reliever. Half of that interchange cost is included in the I-10 Reliever section east of the Loop 101 Extension and the other half in the section from the Loop 101 Extension to the Loop 303 Extension. Only the portion of the Rio Salado Parkway in the SWATS area is included in the estimate.

Improved intersections are included in the cost estimate with right-of-way costs. The cost estimate includes provision for ITS improvements to coordinate traffic signals and improve speed and capacity.

6.2.15 Riggs, Komatke, and Maricopa Parkway

Traffic forecast for the year 2030 does not necessitate an expressway or rural highway along the Rigg, Komatke, Maricopa Road corridor. However, the year 2030 does not represent the build-out year for this portion of the study area. It is recommended that the facility be an ARC, with right-of-way preservation along this corridor to provide a 6 lane expressway or arterial as shown in Figure 6-3. The facility could be upgraded from an arterial to a higher level facility, such as an expressway or rural highway, when conditions warrant, and could be developed further east along Riggs Road.

No costs are included for this right-of-way preservation. It is recommended that right-of-way preservation be undertaken as part of the land development process.

6.3 Transit

This section presents a summary of transit recommendations for inclusion in the RTP. The recommendations include both operating and capital improvements needed to provide effective transit alternatives in the SWATS area.

6.3.1 Regional Fixed Route Bus Transit

The service areas for regional fixed route and demand responsive bus service need to expand as the developed portions of the SWATS area expand westward. It is recommended that service area expansion be included in the RTP consistent with the Regional Public Transportation Authority's Regional Transit Systems Study (RTS), based on expansion of continuous areas of development and fixed route service provided primarily on the arterial network. Figure 6-4 shows the area forecast for service through 2030.

For areas of development beyond the continuous development from the center of Phoenix, peak hour commuter service and other limited services are recommended, similar to the services currently provided to Tolleson and Litchfield Park by the 560, 561, and START bus routes.

The implementation of these services should be timed to match the gradual westward (and southward into southern Goodyear) expansion of development in the SWATS area. The largest capital cost for such services is the acquisition of rolling stock. Rolling stock acquisition depends upon the types of services to be implemented, ridership, headways, route length, and other factors. An estimated $700 million will be needed for rolling stock to serve jurisdictions in the SWATS area. The estimate does not remove portions of jurisdictions, including Buckeye, Goodyear, and Phoenix that are outside of the SWATS area. The estimate is therefore somewhat higher than what would be required to serve the SWATS area itself. That estimate is shown in Table 6-3.

6.3.2 High Capacity Transit

In addition to regional bus service operating on the arterial network, higher speed transit will be needed to respond to the greater distances between developed portions of the SWATS area and the rest of the metropolitan Phoenix area. Consistent with MAG's High Capacity Transit Study (HCTS), it is recommended that light rail (LRT) or bus-rapid-transit (BRT) on a dedicated right-of-way be included in the RTP in a north/south corridor paralleling 51st and 59th Avenues north of Baseline Road and also along the I-10 corridor west of downtown Phoenix to Loop 101. The I-10 corridor route will contribute to congestion relief on I-10 itself forecast for 2030, as noted above.

To serve longer distance trips commuter rail along the Union Pacific railroad tracks from downtown to Buckeye is recommended for inclusion in the RTP. Also recommended is express bus-rapid-transit service on I-10 west of Loop 101 and on Loop 101 and Loop 303 north of I-10, consistent with the HCTS. Figure 6-5 shows these recommended high capacity transit facilities.

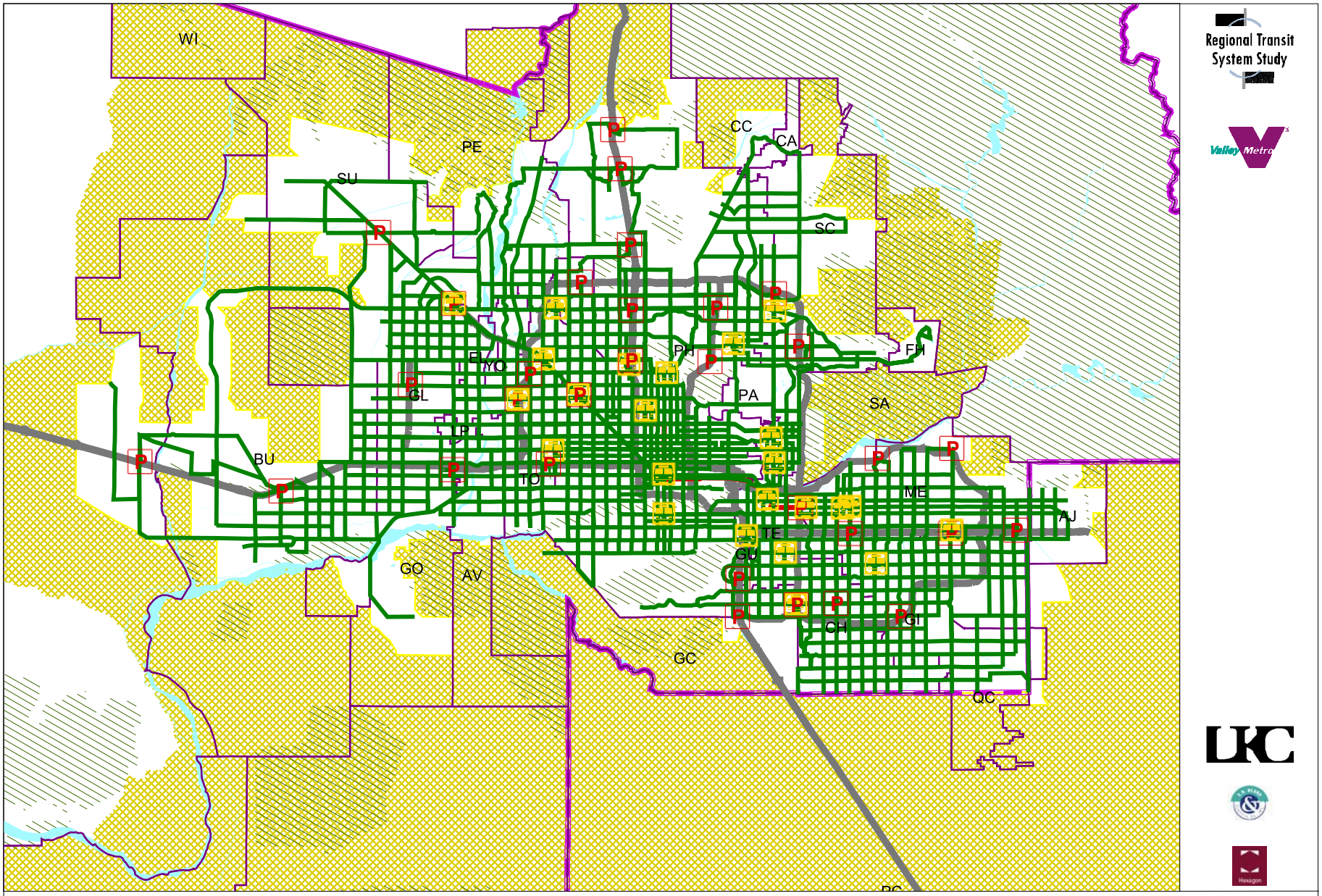
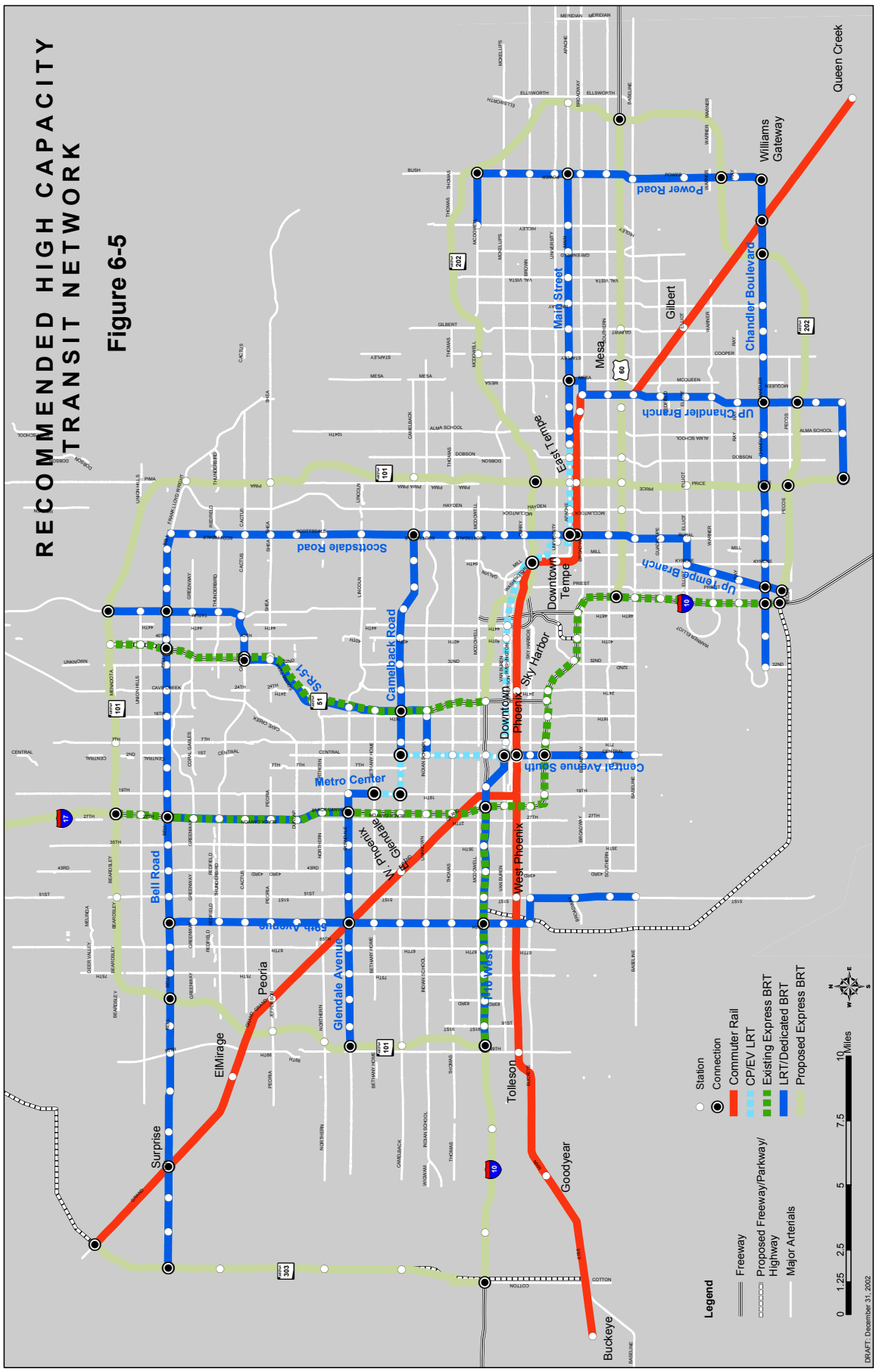


Figure 6-4
2030 Local Transit


RECOMMENDED HIGH CAPACITY TRANSIT NETWORK
Figure 6-5
* Source: MAG High Capacity Transit Plan, 2003
Queen Creek
Williams Gateway
Power Road
Chandler Boulevard
UP Chandler Branch
UP Tempe Branch
Main Street
East Tempe
Gilbert
Mesa
Tempe
Downtown
Scottsdale Road
Camelback Road
SR-51
Sky Harbor
Downtown Phoenix
Central Avenue South
Metro Center
N. Phoenix
Glendale
West Phoenix
Bell Road
Glendale Avenue
Peoria
Mid-West
Surprise
El Mirage
Tolleson
Goodyear
Buckeye
Legend
Freeway
Proposed Freeway/Parkway/ Highway
Major Arterials
Station
Connection
Commuter Rail
CP/EV LRT
Existing Express BRT
LRT/Dedicated BRT
Proposed Express BRT
0 1.25 2.5 5 7.5 10 Miles
DRAFT: December 31, 2002

6.3.2.1 Costs

The capital costs of the recommended LRT and BRT projects with dedicated right-of-way in the I-10 corridor east of Loop 101 and along the 51st and 59th Avenue corridors north of Baseline Road are shown in Table 6-3. The capital cost of commuter rail service between Buckley and downtown Phoenix along the Union Pacific railroad tracks is also shown on the table.

Because they would operate in mixed traffic, the principal capital costs of express bus-rapid-transit service along I-10 west of Loop 101 and along Loop 101 and Loop 303 are the costs of the vehicles themselves. These capital costs of buses are included above under the costs of providing rolling stock for regional fixed route bus transit.

6.3.3 Other Facilities

Additional park-and-ride facilities are recommended for the SWATS area along I-10. There is an existing formal facility along I-10 at 79th Avenue. The RTS proposes three new park-and-ride facilities in the SWATS area. As shown in Figure 6-4, these additional park-and-ride facilities will result in facilities along I-10 at:

- 79th Avenue (existing);
- Litchfield Road;
- Miller Road; and
- 339th Avenue.

6.4 Non-Motorized Facilities

This section presents a summary of the non-motorized facilities recommended for inclusion in the RTP. It identifies a network of paved multi-purpose regional facilities serving the study area. Specific off-road facilities are needed to provide a regional trunk network of paved facilities linking the SWATS area together and providing alternatives to facilities either on or adjacent to streets and highways. Cost topics are also covered. Costs are based on recent construction costs.

A formal functional hierarchy of non-motorized facilities is needed, including both regional trunk facilities and local facilities providing access to activity centers and connectivity with the regional trunk facilities. It is recommended that bike facilities, either on-road using bike lanes or off-road using separate parallel facilities, be included in the RTP for all new and widened arterials. The cost estimate for improvements recommended above for the SWATS area includes the costs of paved bikeway facilities within the rights-of-way.

It is recommended that existing arterials that are not to be widened for motor vehicles be retrofitted where feasible to include a bicycle facility. Costs for such retrofitting are included in the cost estimate for bicycle facility improvements along with all new arterials and existing arterials to be widened. Table 6-1 includes the costs of providing these facilities on arterials, at $200,000 per mile.

Generally these facilities will be provided in the roadway in separate bike lanes. However, separate parallel roadways for non-motorized traffic could be provided in some cases and the cost estimate is based on a path paved with asphalt. The costs of bridges carrying arterials over major rivers have been estimated including wide shoulders to facilitate bicycle traffic.

6.4.1 Non-Motorized Facilities Outside Highway Rights-of-Way

Figure 6-6 shows existing non-motorized facilities not located within a highway right-of-way. Few, if any, of these facilities are improved or explicitly designed as facilities for bicyclists, pedestrians, equestrians, and so forth. A regional system of improved, multi-purpose non-motorized facilities is recommended for inclusion in the RTP.

The facilities shown in Figure 6-7 provide a trunk system of multiple use facilities independent of highway rights-of-way. These facilities are recommended for inclusion in the RTP. Four of these facilities follow rivers in the study area:

- Salt River;
- Gila River;
- Agua Fria River; and
- Hassayampa River.

Except for the Gila River facility, facilities follow the rivers over their entire courses in the study area. Other facilities follow:

- the Grand Canal near Indian School Road in the northeast corner of the study area joining the Agua Fria facility north of the study area boundary;

Figure 6-6
Existing Off-Road Non-Motorized Facilities

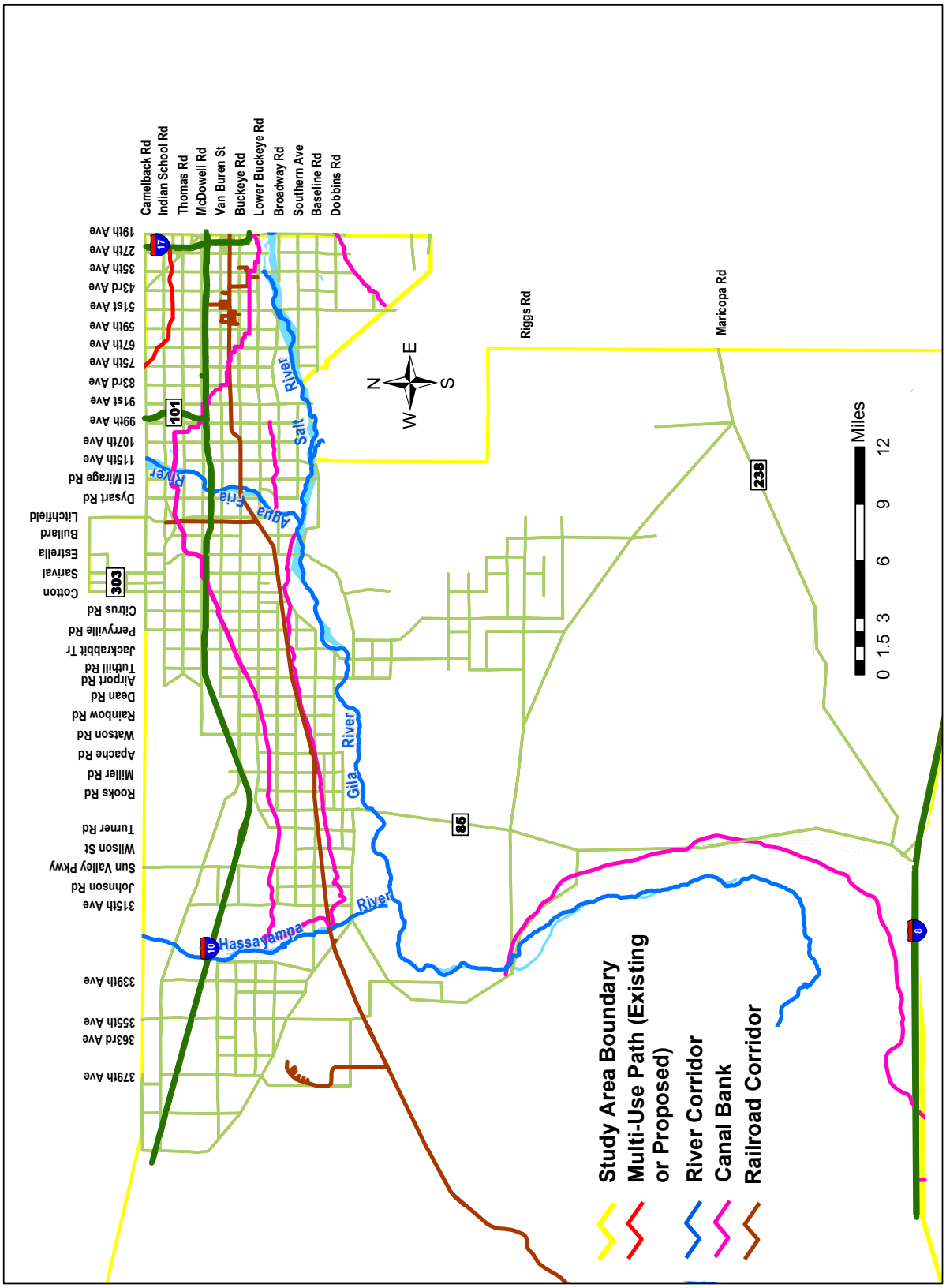
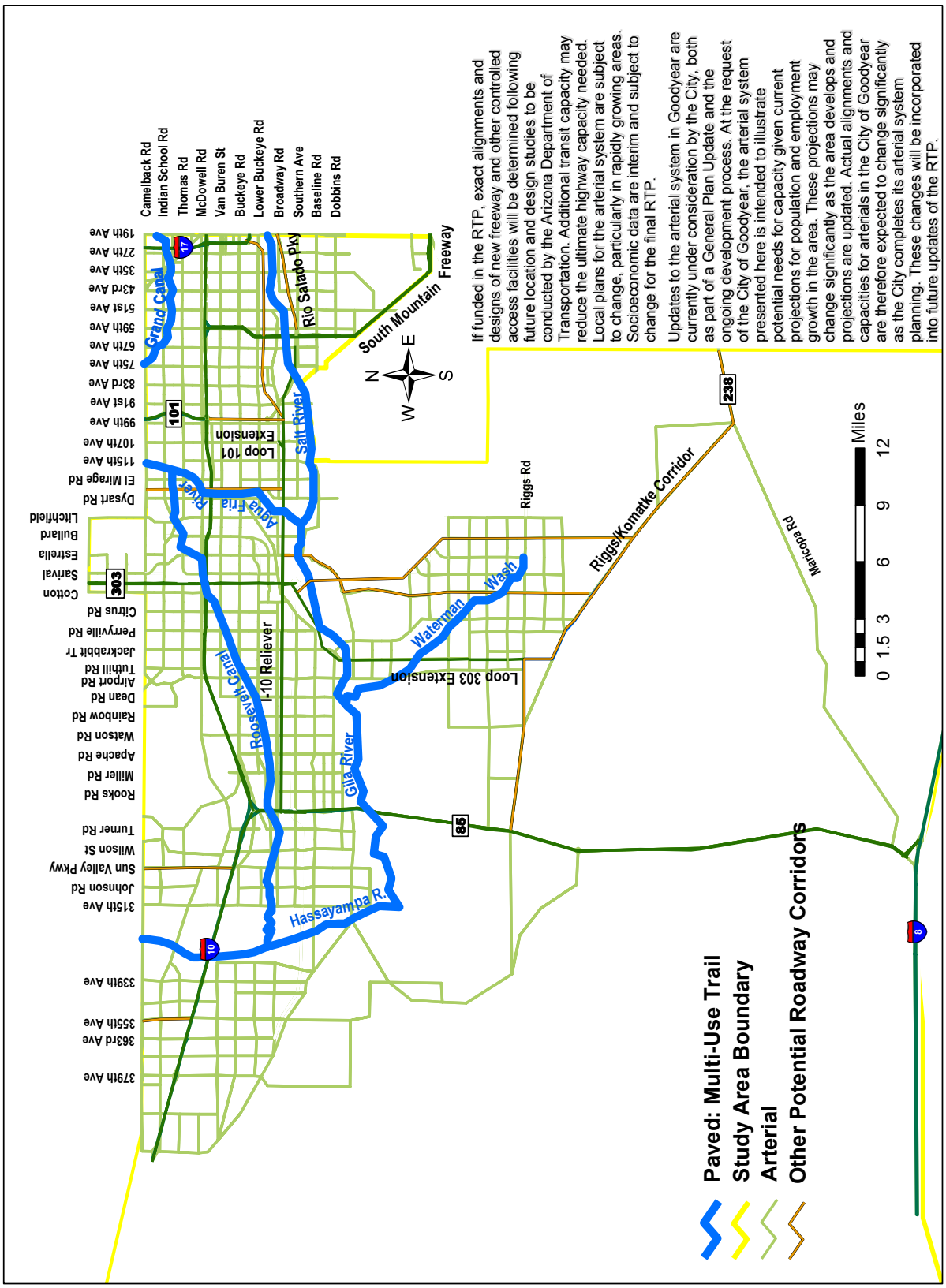


Figure 6-7
Ultimate Trunk System of Paved Off-Road Non-Motorized Facilities



- the Roosevelt Canal from the Agua Fria west to the Hassayampa River facility; and
- Waterman Wash south from the Gila River facility.

These facilities provide the extensive network of off-road facilities shown in Figure 6-7. Power lines, gas lines, railroad rights-of-way, and other physical features may also represent potential non-motorized corridors and further study will be needed to identify appropriate facilities at these locations. The cost estimate for the facilities shown on Figure 6-7 is presented on Table 6-3. The cost of these facilities is estimated at $360,000 per mile. The estimate for the Grand Canal facility is only that portion in the SWATS area. The estimate for the Gila-Salt River facility east of the Rio Salado Parkway crossing of the Salt River (at approximately 75th Avenue) is included in the cost estimate for the Rio Salado Parkway, which will parallel the southern bank of the Salt River east of 75th Avenue.

6.5 Summary of Costs

Table 6-3 shows that $12.9 billion is needed to meet the recommended highway and non-motorized facility needs of the SWATS area over the next 30 years. About $3.9 billion of that total is needed for the arterial system. It is likely that well over half of the investment in arterial highways will be provided by the private sector as a part of land development. If $3.0 billion were provided by the private sector for the arterial system, an investment of $9.9 billion will be necessary by the public sector for highways, transit, and non-motorized facilities in the SWATS area.

Table 6-3 shows that rolling stock for expansion of the regional fixed route bus system to serve the SWATS area in 2030 will require an investment of $700 million. Of the $12.9 billion needed to fund the recommended transportation facility needs of the SWATS area over the next 30 years, 56% is needed for investment in new facilities. About a third (31%) of the funding is needed to widen existing roadways. The remaining funding is needed to improve and add intersections and interchanges, improve major river crossings, provide ITS capabilities throughout the highway system and roadway network, expand the current transit system, and provide bicycle and other facilities for non-motorized uses.

6.6 Policies

6.6.1 Variable Width Roadways ("Scalloped Streets")

Variable width roadways, often referred to as "scalloped streets," occur as a result of roadway segments being constructed at different times. The scalloped street may not be constructed according to the jurisdictional standards. The scalloped streets problem affects the efficiency of the arterial grid network by reducing capacity, causing congestion, and reducing levels of service. It is recommended that a Scalloped Streets Policy be adopted by the local jurisdictions along with a mechanism for funding the roadway improvements. One suggestion is to collect impact fees from developers and then create a fund that can be used as needed.

6.6.2 Arterial Grid Continuity

Regionally, the arterial grid system acts as an overflow for congested freeways, expressways, and other higher level facilities in addition to accommodating local traffic. The existing arterial grid network also provides the basic access and connections for non-motorized (bicycle and pedestrian) modes of travel. New communities continue to be developed and the street systems may not be consistent with the grid system or may not provide adequate connectivity to the existing grid system. Closing the gaps in the arterial grid network and mitigating the obstructions to constructing the grid network should continue to be a fundamental regional objective.

6.6.3 Preservation of Right-of-Way

The early protection of rights-of-way for all modes of travel should become a regional policy supported by all cities. It is recommended that rights-of-way of planned, future facilities be protected or preserved, where possible, before development takes place.

A prerequisite for selecting corridors for preservation is the presence of a Transportation Plan, such as the RTP. Agencies and groups that should be included in corridor preservation activities include the Federal Highway Administration (FHWA) and Federal resource agencies (EPA, Corps of Engineers, etc.); ADOT, the state legislature, and state resource agencies; County, City Council, mayors and executives, planning commissions, city planning, and public works departments; Land owners, developers, chamber of commerce, and bankers; Corridor neighborhood and civic groups, umbrella public interest groups, and environmental activists.

Means that can be employed to assist in the successful planning and implementation of roadway improvements include two basic categories:

1) **Interim protection techniques**, such as official maps of reservation, and options to purchase at a later date, strive to hold land out of development until right-of-way purchases can be made or land titles transferred.

2) **Preservation techniques** to ensure that right-of-way is, or will be, available for a transportation facility when needed. Preservation techniques include such measures as fee simple acquisition, landowner donations, and development easement acquisitions.

6.6.4 Avoid Creation of T-Intersections

The creation of T intersections should be avoided. Currently major T intersections occur at I-10 and SR 85 and at Sun Valley Parkway and I-10.

6.6.5 Safety and ITS

Projects that improve the safety and efficiency of the transportation system should be high regional priorities.